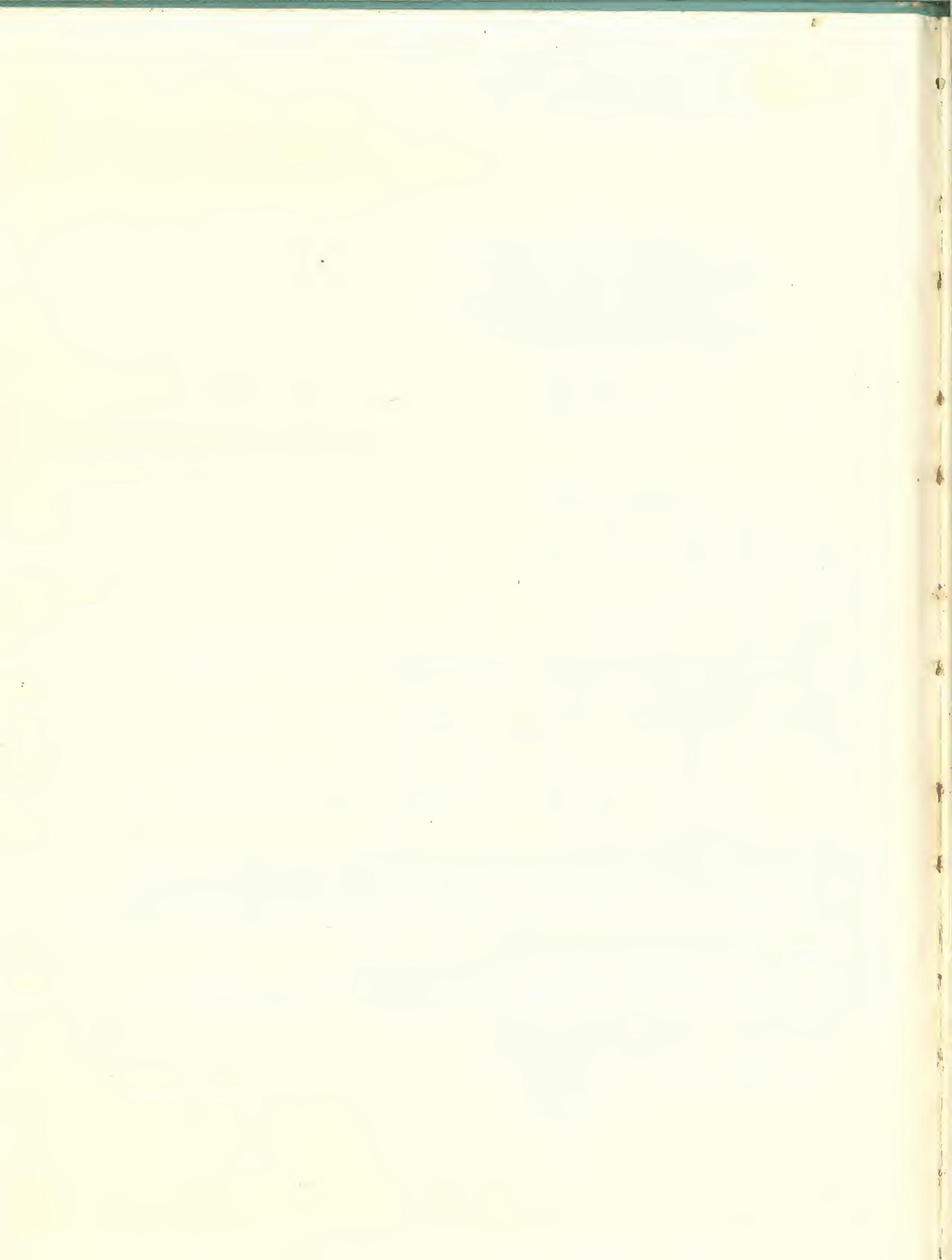




CONCRETE IN ARCHITECTURE



CONCRETE IN ARCHITECTURE



PORLAND CEMENT ASSOCIATION
CHICAGO

The Portland Cement Association wishes to express its sincere appreciation of the cooperation so generously given by those architects and artists who have collaborated in furnishing the material presented in this publication.

*Copyright 1927
Portland Cement
Association*

FOREWORD

THE beauty inherent in concrete has long lain dormant, hidden from view, awaiting only the genius of the designing mind to reveal it. In the pages which follow, illustrations are presented that show how this beauty has now been revealed by the creation of enduring decorations possessing much architectural merit.

No attempt has been made to treat adequately the many decorative uses of concrete. Such a task would obviously be impossible in a publication of this size; therefore, only a few noteworthy examples in widely separated parts of the country are illustrated.

Especial prominence has been given to the staining and painting of concrete and also to that exposed aggregate concrete which has been produced through a new technique.

By applying stained and painted decoration to load-bearing concrete members, a strength and a dignity are obtained which could never be created by any amount of ornamentation that masks the structural members and robs them of their vigor and vitality.

The other new method of decoration has also given remarkable results. Exposed aggregate concrete has proved itself an architectural medium of the highest order which may be employed for creating surfaces of rare charm and beauty that in color, texture and richness rival the finest marbles and the best mosaic.

In the work illustrated no deviation from a high standard of decorative excellence was permitted by the consideration of economy; nevertheless, the use of concrete as a decorative material did achieve an appreciable saving. By staining and painting directly on concrete a most gratifying economy was obtained and, in spite of the fact that the highest technical knowledge and craftsmanship were required for creating the new type of exposed aggregate concrete, the cost of such work was far below that which would have been entailed by the use of other materials of equal richness and quality.



Marshall and Fox, *Architects*

EAST LOUNGE ROOM
EDGEWATER BEACH HOTEL, CHICAGO, ILLINOIS

Strength and dignity, the dominant elements of this ceiling, are obtained by exposing the massive concrete beams and decorating them with stains and painted designs in many colors.

THE EDGEWATER BEACH HOTEL

By BENJAMIN H. MARSHALL

IT HAS always been our belief that in many kinds of rooms the structural elements could be used to produce better artistic results than those usually obtained by the ordinary methods that hide completely, or at least mar, the grace of line and form of load-bearing members.

Very satisfactory results were obtained in the Edgewater Beach Hotel in Chicago, where the ceilings in the East and West Lounge Rooms, and also those in the Passaggio, were constructed so that the structural members themselves constitute an integral part of the decorative scheme.

The inspiration for the design of these ceilings was obtained from the Davanzati Palace at Florence, Italy. The ceilings of this old palace were constructed of wood, as were many other ceilings built during the same period, and the decorations in color were applied to the heavy timber beams. However, in a modern structure, such as the Edgewater Beach Hotel, it was necessary to use fireproof materials and concrete, therefore, was chosen as the material for the execution of the design.

In order to get a texture very similar

to that of wood, the forms were built of undressed lumber which was left just as it came from the coarse saws. Just before the placing of the concrete, the form lumber was thoroughly wetted so as to cause the grain marks to show more prominently on the concrete surface. The concrete was especially proportioned in order to obtain that degree of plasticity which would permit all the interstices to be filled without excessive spading. When the forms were stripped the imprints made by the grain of the wood appeared much better than we had anticipated.

After the concrete had been permitted to season, it was stained the color of old wood beams, and decorations in many colors were applied to the soffits of the beams and girders by means of stencils. We have found from our experience on other structures that excellent results may also be obtained by applying the decorations by hand without the use of stencils.

From the experience we have had with this type of construction and decoration, it is our belief that it is considerably more economical than any other which could produce ceilings of equal weight and richness.



Marshall and Fox, Architects

EAST LOUNGE ROOM
EDGEWATER BEACH HOTEL, CHICAGO, ILLINOIS

This stained concrete ceiling with its painted decorations resembles very closely in color and texture the old wooden ceiling in the Davanzati Palace at Florence, Italy, which inspired the design.



Marshall and Fox, Architects

WEST LOUNGE ROOM
EDGEWATER BEACH HOTEL, CHICAGO, ILLINOIS

The massive grandeur of this stained concrete ceiling and the excellent lines of the unusual fireplace create an admirable ensemble obtained, primarily, by skill in designing the essential parts and not by the addition of ornaments.



Marshall and Fox, Architects

THE PASSAGGIO
EDgewater BEACH HOTEL, CHICAGO, ILLINOIS

An excellent example of the masterly proportioning of stained concrete beams and the restrained use of brilliant paints. The determination of the proper camber for the girders is, of course, an essential element in such designs.



Marshall and Fox, *Architects*

WEST LOUNGE ROOM FROM THE PASSAGGIO
EDGEWATER BEACH HOTEL, CHICAGO, ILLINOIS

These splendidly proportioned concrete beams are themselves graceful and beautiful, but additional prominence has been given them by the application of simple painted decorations.



Benjamin H. Marshall, *Architect*

RECEPTION HALL
STUDIO OF BENJAMIN H. MARSHALL, WILMETTE, ILLINOIS

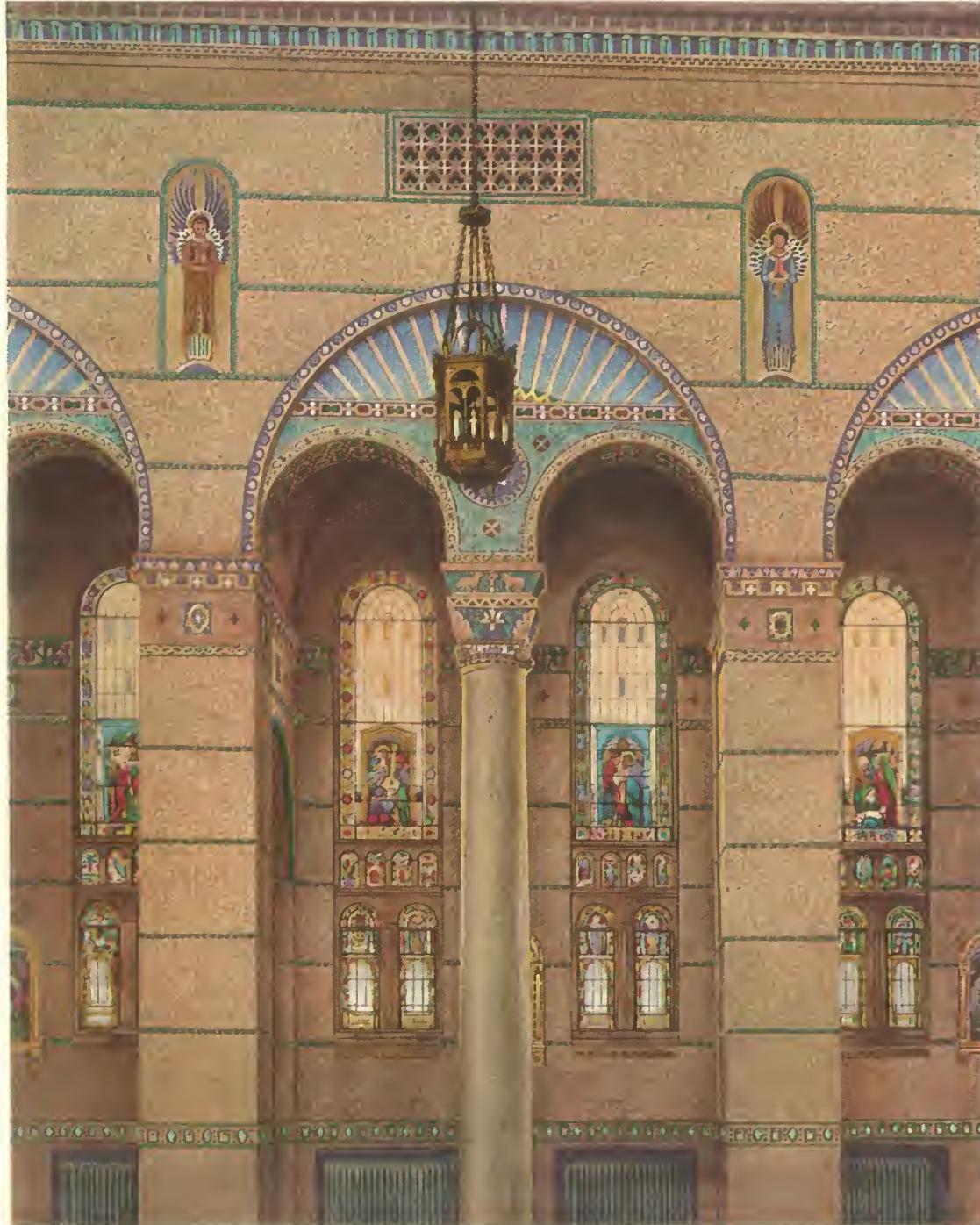
A texture similar to that of coarse-cut timbers has been given to these concrete beams by sawing the form lumber in a special manner. Greater prominence and a fitting distinction have been added to this excellent ceiling by the very restrained use of simple stenciled designs.



Benjamin H. Marshall, *Architect*

ENTRANCE
STUDIO OF BENJAMIN H. MARSHALL, WILMETTE, ILLINOIS

Decoration that will withstand severe weathering conditions has been obtained in this charming frieze by the use of sgraffito executed in portland cement stucco. Relief and also an infinite variety of permanent colors and textures are available for the artist in such work.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

SHRINE OF THE SACRED HEART, WASHINGTON, D. C.

In the Shrine of the Sacred Heart there have been wrought in concrete, walls as rich as those produced with the rarest marbles, and decorations, symbolic of a mystic faith, have been created as excellent as those produced in the best mosaics.

SHRINE OF THE SACRED HEART

By FREDERICK V. MURPHY

ARCHITECTURAL expression has ever been dependent upon the intrinsic merit of such materials as were available at the moment of building. Various countries where nature did not furnish any durable materials have seen their structures crumble to dust and in the process of disintegration much of the artistic development attained in the building of these structures has been lost. It is, therefore, expedient to build well at all times, and as Vitruvius has said, with due regard for the equally important qualities of stability, utility and beauty.

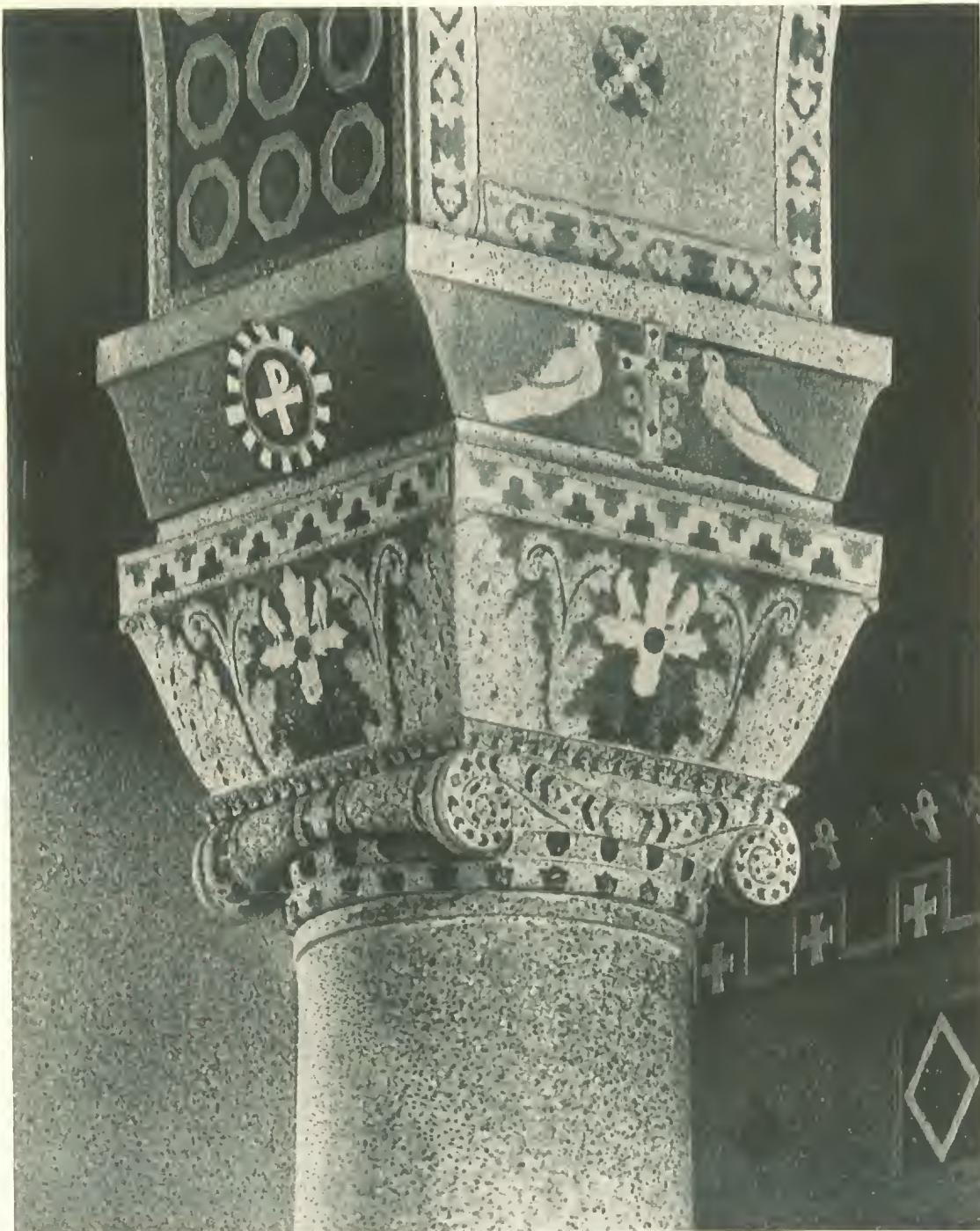
Satisfactory materials of construction must possess those qualities of color, texture and integrity that are necessary for rendering a design in terms which will not detract from the carefully prepared project of the architect. Materials of construction which would appear too foreign if juxtaposed with other materials can never be seriously considered.

It must be remembered also, in the search for the proper materials of construction, that control of the final appearance is essential. The use of materials that are subject to objectionable variations or that involve any speculation whatsoever about the final expression of an edifice cannot be condoned.

Exposed aggregate concrete of the new type which was used in the Shrine of the Sacred Heart at Washington, D. C., satisfied in no uncertain measure all these essential requirements. Of a strength equal to or greater than stone, free from disconcerting modifications brought to light during its application, and possessing a character in color and texture always responsive to the thought of the designer, concrete was given sufficient nobility to associate with other materials having long histories of honorable employment in monumental art.

Complicated decorative detail in the Shrine of the Sacred Heart was rendered in a great variety of colors through the use of exposed aggregate concrete. The desired effects were obtained without the admixture or imitation of other and perhaps more costly materials.

Artistic ingenuity and additional study will doubtless enhance the decorative value of concrete and create for it a variety of uses even greater than at present. However, the results already attained have proved that concrete can be made to fulfill exacting demands for variety in surface, color and texture and at the same time to retain its qualities of permanency and economy. These facts alone presage a wide use of this material for decorative purposes.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

SHRINE OF THE SACRED HEART, WASHINGTON, D. C.

These designs have been produced in concrete through the use of a new technique which causes the aggregates to be the dominant surface elements and which controls precisely the characters and positions of the various colored particles.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

SHRINE OF THE SACRED HEART, WASHINGTON, D. C.

Exquisite craftsmanship and the highest technical skill in the blending of colored aggregates have here produced surfaces of peculiar charm and great beauty at a cost far below that of other materials of equal richness and excellence.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

SHRINE OF THE SACRED HEART, WASHINGTON, D. C.

When no single aggregate could be found that would give a color essential in these designs, particles of differently colored aggregates were blended in such a way that at a short distance the optical sensation produced was identical with that caused by the required color.

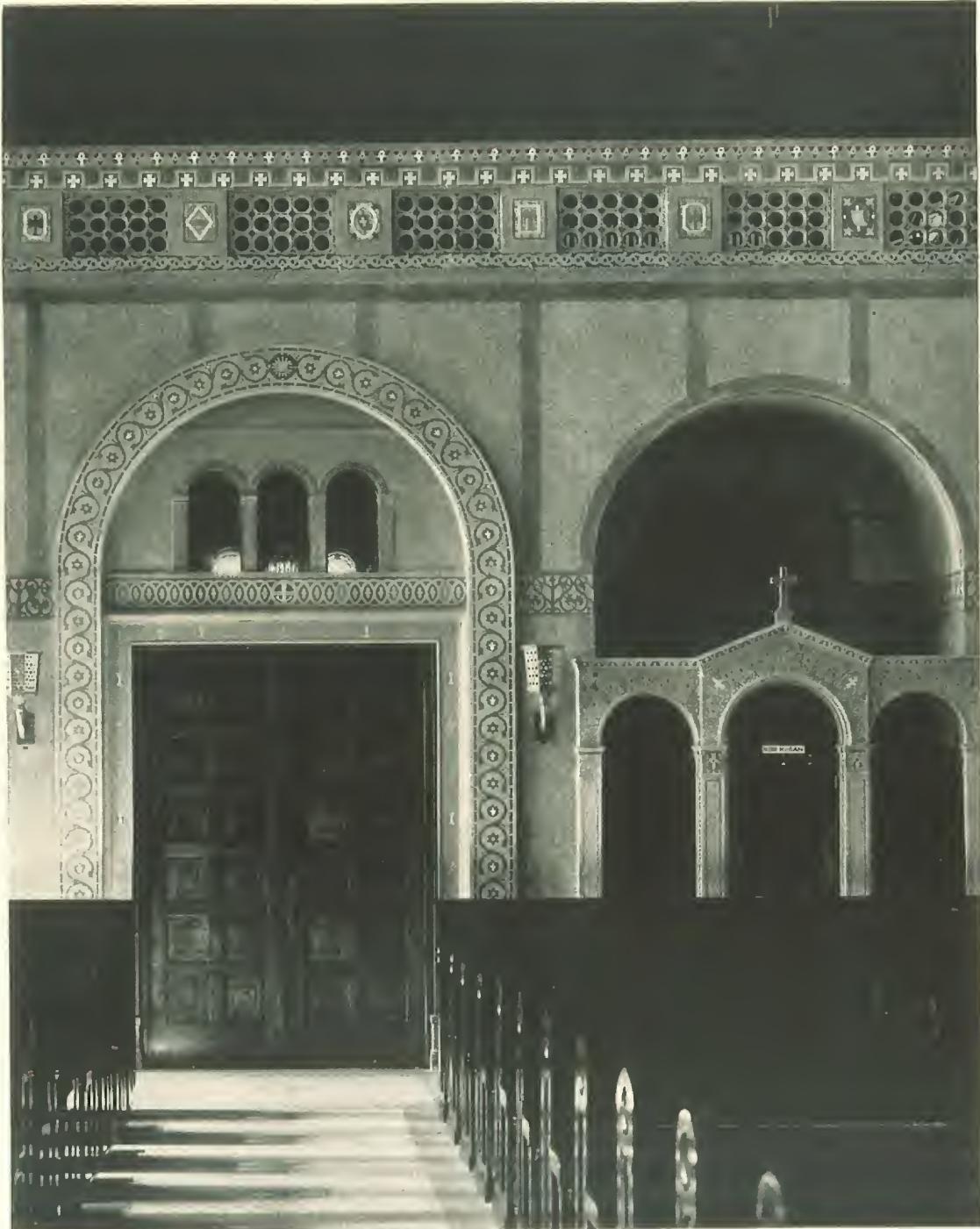


John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

SHRINE OF THE SACRED HEART, WASHINGTON, D. C.

All the details of enrichment seen here, as well as the columns and walls themselves, have been executed in exposed aggregate concrete. The decorative effects produced are comparable to those obtained in other materials by highly skilled workmen centuries ago.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

SHRINE OF THE SACRED HEART, WASHINGTON, D. C.

The technique of creating exposed aggregate concrete, such as this, prevents the cement-water paste from dominating the finished appearance and makes possible the blending of the various aggregates into intricate forms and patterns of delicate beauty.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

SHRINE OF THE SACRED HEART, WASHINGTON, D. C.

These surfaces were not produced by the use of polished marbles, ceramics or mosaics — they were all constructed of one material, exposed aggregate concrete. The many-faceted particles of such surfaces diffuse and mellow the rays of light.



Allison and Allison, Architects

CEILING DETAIL
UNIVERSITY CLUB, LOS ANGELES, CALIFORNIA

A unique ceiling where the marks made by the metal forms constitute an integral part of the texture. The natural slight irregularities of the beam soffits do not appear as blemishes but impart a hand-wrought appearance.

THE UNIVERSITY CLUB OF LOS ANGELES

By DAVID C. ALLISON

UCH buildings as the Shrine of the Sacred Heart in Washington, the facsimile of the Athenian Parthenon in Nashville and the Palace of the Legion of Honor in San Francisco, all marvelously executed in concrete, are typical of the growing volume of work in this material throughout the country and are rapidly winning for it a new respect in the eyes of the architectural profession. Concrete is no longer considered a material adaptable only to the cruder forms of construction—the viaduct, the dam and the warehouse—because the full range of its aesthetic potentialities are now realized. It can be made suitable for molding, modeling and carving, and an infinite variety of textures and colors may be obtained in concrete by the use of surface treatments, stains or stucco. In short, concrete is now a medium suitable for the production of highly developed architecture.

The possibilities of concrete intrigue the imagination of a designer because they offer the opportunity to create an essentially monolithic building, in which much that has been learned about the column and girder type of construction may be combined with those ele-

ments of design which can be achieved only in monolithic work.

A whole building with walls, columns and girders all of the same fabric may be made essentially one piece in concrete at a cost most gratifying to the owner.

Results which had already been obtained in other buildings led to the adoption of this type of construction for the University Club of Los Angeles. This structure is practically devoid of ornamentation except at the entrance and first-story street front, where a facing of wet-mix cast stone was used. The monolithic concrete was given only one dash coat of cement stucco, thrown on the concrete with a brush. This coating was thin enough to allow practically all the form marks and irregularities of the wall to show through. The effect obtained by this treatment was quite satisfactory.

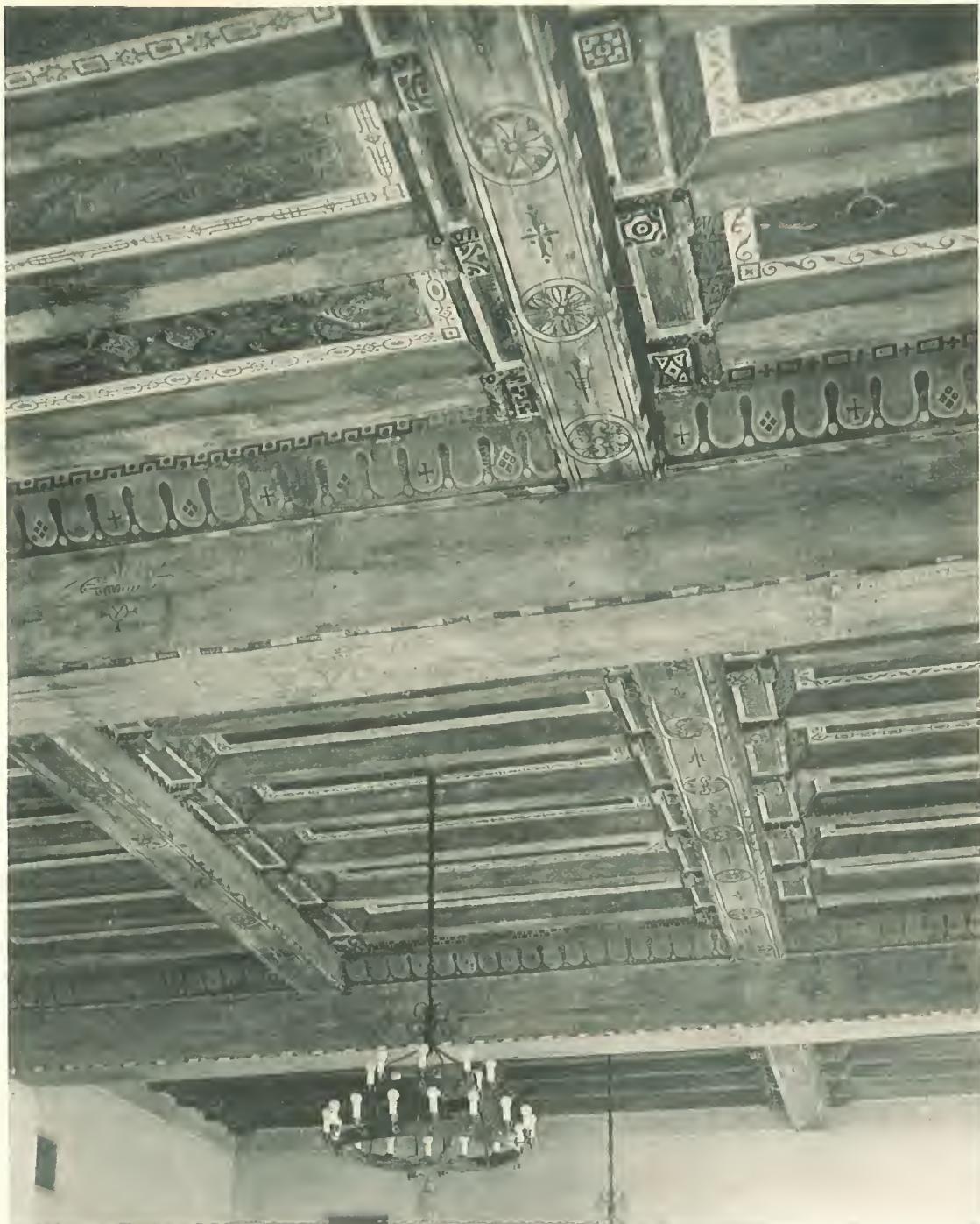
In the future, results which are better expressive of the aesthetic values in concrete will doubtlessly be achieved by the development of new methods of construction and new types of ornaments. Much has already been done in this field and because of the increasing appreciation and interest which are being shown in it, a new type of American architecture will evolve.



Allison and Allison, *Architects*

ENTRANCE
UNIVERSITY CLUB, LOS ANGELES, CALIFORNIA

The coarse texture obtained by leaving the marks of the forms plainly visible contrasts boldly with the finely molded detail executed in cast stone.



Allison and Allison, *Architects*

CEILING OF THE SILENT ROOM
UNIVERSITY CLUB, LOS ANGELES, CALIFORNIA

Thin stains permit the grain marks left by the form lumber to be clearly seen. The use of thick films of stains or paints here would have hidden this excellent texture and marred the entire ceiling.



Allison and Allison, *Architects*

A DECORATED CEILING
WOMEN'S ATHLETIC CLUB, LOS ANGELES, CALIFORNIA

By painting directly on this concrete ceiling a charm in texture and an excellence of tone were obtained. Such effects cannot be obtained by painting on hard, smooth plastered surfaces.



Allison and Allison, *Architects*

ASSEMBLY ROOM
WOMEN'S ATHLETIC CLUB, LOS ANGELES, CALIFORNIA

The well-proportioned concrete beams and the stenciled designs which have been applied to them have created a ceiling of good taste, dignity and appropriate simplicity.



Allison and Allison, *Architects*

UNIVERSITY CLUB, LOS ANGELES, CALIFORNIA

This concrete building was given only one dash coat of stucco and retains all the qualities of ruggedness, strength and natural integrity of the material. The roof garden over the garage is an unusual feature of this structure.



Allison and Allison, *Architects*

WILSHIRE BOULEVARD CONGREGATIONAL CHURCH, LOS ANGELES

In this monolithic concrete structure, the surface shows clearly the substance of which it is made. Pre-cast stone was used at the entrance doors and for the colonnettes, but most of the remaining decorations were cast monolithically.



William Lee Woollett, *Architect*

MEZZANINE
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

In this theatre the structural forms of the concrete frame were modified but slightly by the addition of moldings or other ornament. By casting a simple design on the exposed balcony trusses, a unique distinction was given to this decoration.

METROPOLITAN THEATRE

By WILLIAM LEE WOOLLETT

THE design of the Metropolitan Theatre was conceived while the issues of the great war were still reverberating in the public mind and registers the grinding of cosmic forces let loose by the war. The design is a symposium of apparently conflicting elements—a melange of familiar architectural forms combined with the structural members of a modern reinforced concrete structure.

The thesis for the problem presupposes the fragments of an ancient temple or temples to be still standing—into which is thrust the reinforced frame of a modern theatre. The isolated masses of the antiquated remains of the classic buildings are composed in groups so that they seem to be like choice fragments set up in a museum, yet they are a part of the structure. The compositions in color, which arrive from the juxtaposition of these architectural fragments and the newer forms in concrete, are complex. The concrete wall surfaces are gilded and colored and decorated with murals and conventional patterns. The motifs used were taken from every known architectural style and modified to harmonize with the scheme as a whole.

If there is a law of harmony in line

and color, there is also a law of dissonance. The law of dissonance is part of the universal law and constitutes a useful part of the laws of beauty. The antitheses, rather than the harmonies, have been used in the Metropolitan Theatre and a dissonance has been obtained which caused one architect to make the remark, "Everything is just the opposite of what it ought to be."

In no place is the dignity of the new type of construction, reinforced concrete, defamed by seeming to be that which it is not. The gaunt forms of the concrete frame are but slightly modified by the introduction of classic moldings or other ornaments easily cast with the concrete without concessions from the engineering functions.

Very pleasing effects were easily obtained on concrete left exposed above the wainscot line and it was found that in the lower areas a friendly surface could be obtained by filling the pores with paints or other pigments and subsequently finishing with varnish and beeswax. A great richness of surface was also obtained by the use of Dutch metal and varnish. The results achieved indicated that concrete lends itself gracefully to the architect who knows how to use its textures to advantage.



William Lee Woollett, *Architect*

MURAL, "PRINCESS OF THE GOLDEN KINGDOM"
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

The rich oriental hues in a mural such as this which has been painted directly on the concrete may be preserved indefinitely by the use of transparent protective coatings.



William Lee Woollett, *Architect*

MEZZANINE
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

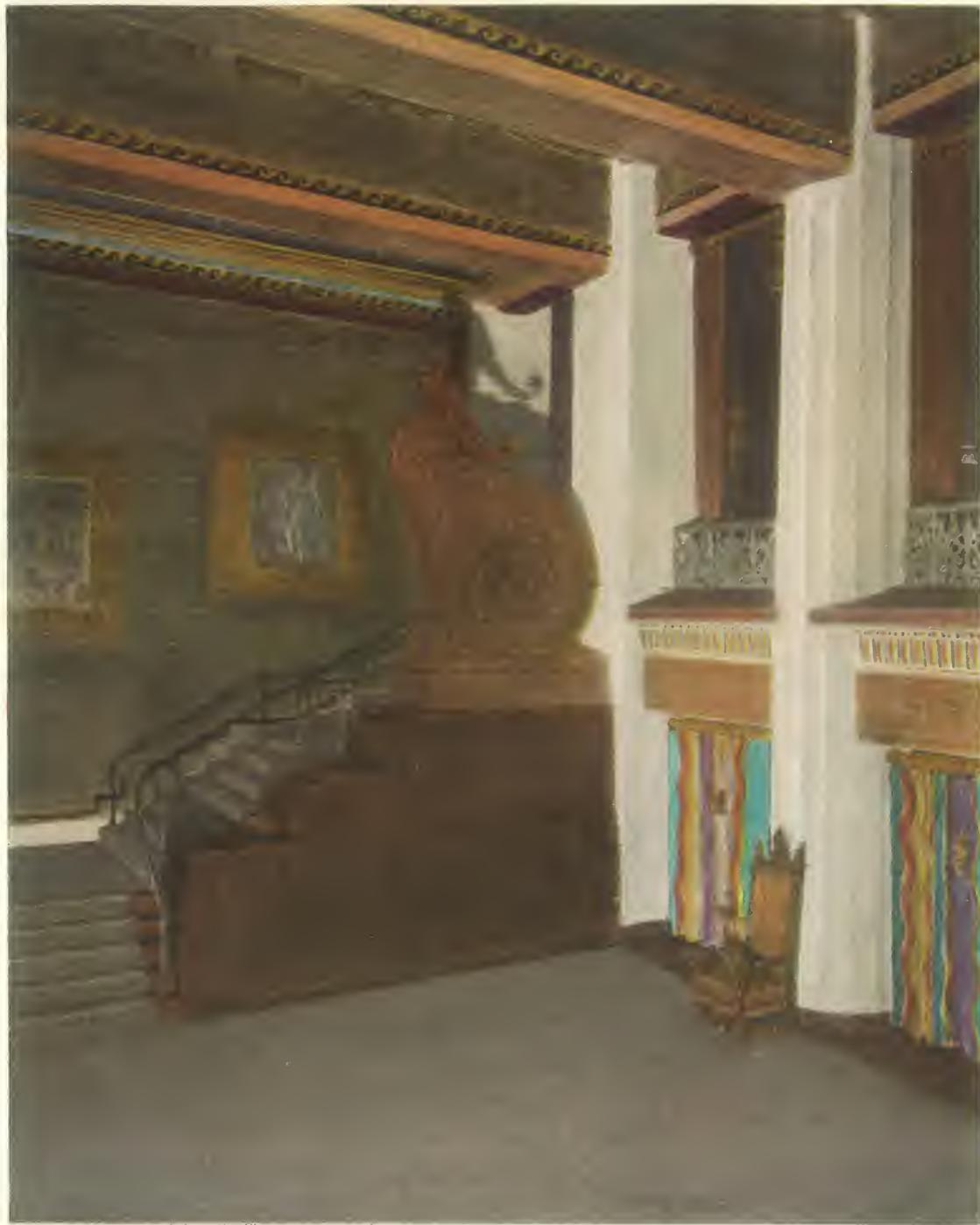
These decorations do not mask but emphasize the lines and forms of the structural members. The mural shown on the opposite page may be seen here between the trusses.



William Lee Woollett, *Architect*

BALCONY ENTRANCE
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

This portal represents one of the ancient temple fragments which supposedly were still standing when the reinforced concrete frame of a theatre was built around them. The white texture was obtained by the use of white portland cement, and the concrete urns were covered with gold-leaf.



William Lee Woollett, *Architect*

SNAIL DEER IN THE LOBBY
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

In this extraordinary composition, antitheses rather than harmonies have been used in a strange mixture of architectural motifs. No single material but concrete could have been employed so successfully for such a wide diversity of uses.



William Lee Woollett, *Architect*

LION AND REPTILE COMBINED
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

This concrete ornament was given a metallic appearance by applying layers of paint, Dutch metal, gold-leaf and varnish. It was smoothed and polished by rubbing with pumice. The panne velvet hanging on the wall was designed by the architect.



William Lee Woollett, *Architect*

PROCRASTINATION, "THE SPIRIT OF THE BUILDING"
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

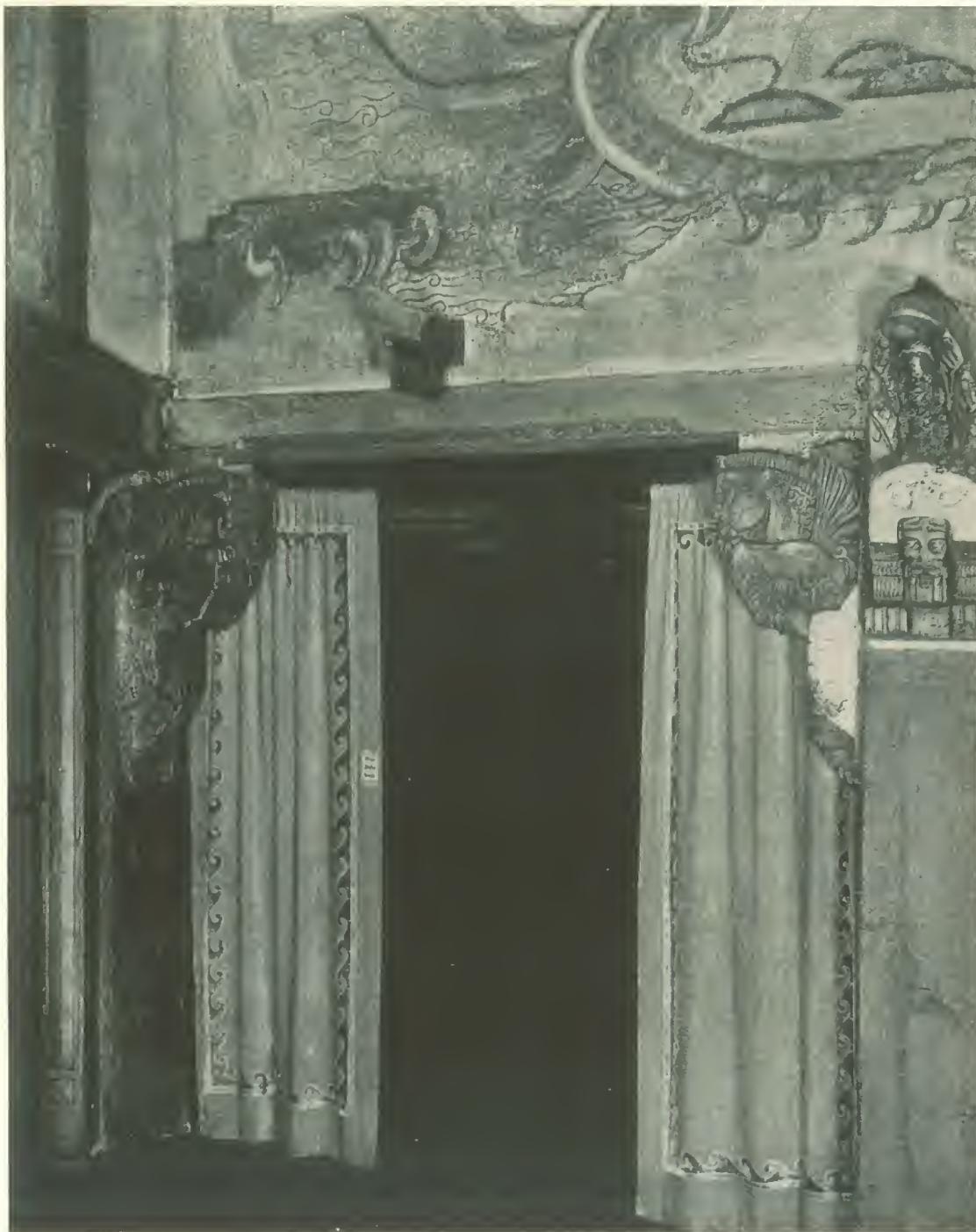
This fantastic ornament, which was designed by the architect and cast in concrete, has the body of a glorified garden slug. Vivid and novel contrasts have been obtained by the great divergence of elements in this museum-like group.



William Lee Woollett, *Architect*

NICHE IN THE BALCONY WALL
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

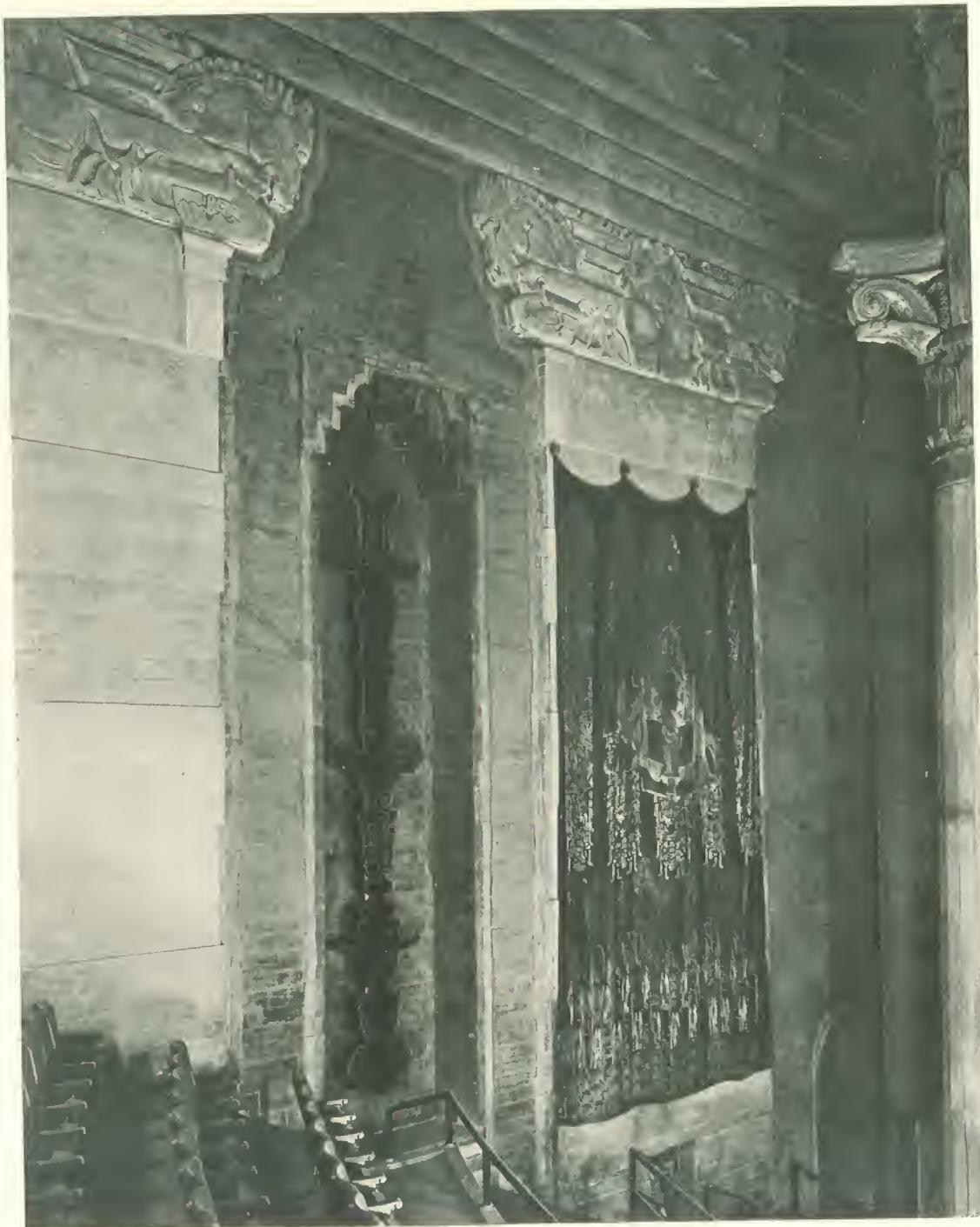
This unusual treatment of a large wall space is impressive in its simplicity and massiveness; it holds a hint of ancient architecture and the splendor of pagan temples. An added ruggedness was given to the surface by the uneven placing of the form lumber.



William Lee Woollett, *Architect*

AISLE PORTAL
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

These concrete column decorations were cast in place and finished with gold-leaf and graphite. The mural above the portal was painted on the rough concrete.



William Lee Woollett, *Architect*

BALCONY WALL
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

The dissonance expressed here by the melange of architectural forms is typical of the entire decorative scheme of this theatre. The concrete ornaments in low relief were cast in place. The totem pole is made of black leaded glass.



William Lee Woollett, *Architect*

BRACKET ON A CONCRETE WALL
METROPOLITAN THEATRE, LOS ANGELES, CALIFORNIA

A more frank use of monolithic concrete for decorative purposes can scarcely be conceived. The imprints made by the form lumber have created a texture of much interest.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

ENTRANCE GATE
FRANCISCAN MONASTERY, WASHINGTON, D. C.

Distinction has been given to this entrance gate by a splendor of color obtained through the use of exposed aggregate concrete. Designs of many hues and of delicate intricacy have been wrought in an enduring material.

FRANCISCAN MONASTERY

By JOHN J. EARLEY

IN THIS great industrial era, the twentieth century, mechanical duplication has greatly increased the output of industrial workers. The corresponding increase in their wages has been reflected in the Arts where there are no similar methods of duplication. The cost of individual pieces made by well-paid craftsmen has become so high that architectural decorations composed of such units are no longer within the usual economic limitations of building, and therefore new methods are now necessary.

A plastic material meeting all of the architect's requirements for form, color and texture as well as for permanence would afford the economic relief that must be obtained if the practice of architecture, as an art, is to be saved from disassociation with building.

The solution of the problem, then, is the development into an architectural medium of a plastic material possessing strength and permanence. Such a medium, because of its plastic nature, would require less labor to mold and shape than is necessary with a solid material.

Modern portland cement concrete is a permanent, plastic material. It has been tested and accepted by the engineering profession as an eminently satisfactory building material. This acceptance viewed against a background of history, both ancient and modern, has established the confidence of architect and artist in the permanence of concrete and has aroused the desire to develop its artistic possibilities.

The process used in making the concrete illustrated here consists in selecting, grading and placing the aggregates, or stones, so that when bound together with portland cement the color and texture of the resulting concrete will be the color and texture of the aggregate. Cement is used only as a binder and counts for little in the appearance of the finished surface.

By this process concrete is made to be an artistic medium both facile and durable. It exercises no restraint on the architect or artist, but on the contrary affords a freedom in design such as has not been enjoyed since the cost of translating works of art into permanent materials restrained the practice of art.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

WITHIN THE ENTRANCE GATE
FRANCISCAN MONASTERY, WASHINGTON, D. C.

Exposed aggregate surfaces have been created here on the sidewalks and roadways as well as on the structure itself. By blending the particles of colored aggregate with artistic skill, even the broad surfaces themselves have been made attractively warm and rich.



John J. Earley
Architectural Sculptor

Murphy and Olmsted
Architects

A CORNER OF THE CLOISTER
FRANCISCAN MONASTERY, WASHINGTON, D. C.

In this ambulatory, which is more than a quarter of a mile long, unique and charming colors and textures have been woven into enduring surfaces of exposed aggregate concrete that must withstand severe weathering conditions.



Julian E. Garnsey
A. W. Parsons
Mural Painters

Bertram G. Goodhue, *Architect*; Carleton M. Winslow, *Associate Architect*
Successors: Carleton M. Winslow and the Bertram G. Goodhue Associates

REFERENCE ROOM
PUBLIC LIBRARY, LOS ANGELES, CALIFORNIA

The shields painted on these concrete girders have historical significance. They were placed at the center of the span and surrounded by carefully designed patterns in order to correct the optical illusion that beams, even though precisely horizontal, appear to sag.

DECORATION OF THE LOS ANGELES PUBLIC LIBRARY

By JULIAN ELLSWORTH GARNSEY

IN THE Central Building of the Los Angeles Public Library the painted decoration was executed directly upon the concrete ceilings. The late Bertram Grosvenor Goodhue had decided to use this method of decoration and by retaining it a solution of an entirely new problem in monumental architecture has been obtained.

The ornamental scheme for each room has been designed to reveal and emphasize the construction of the surface on which it was applied. In the Rotunda, for example, there are radial elements which reinforce the upward thrust of the dome—circular borders and interlaceries which bind it together at the top and at the spring line and, in the pendentives, full circles which hold apart the converging arches. In the various beamed ceilings the relation between the forces carried by the large and small load-bearing members is indicated by the relative strengths of the ornaments, and focal points are marked with appropriate spots, such as the shields on the main beams in the Reference Room.

With few exceptions, only geometrical forms have been used in the ornament because decoration of any kind must harmonize with the nature of the material it decorates. Floral forms or

scrolls are more appropriate for plaster or wood than for concrete. In these designs the concrete texture has been brought through the painted decoration in order that the latter may appear imbedded in the concrete and not merely applied to the surface.

Color is used in this building in traditional combinations and in a way to assist the ornamental schemes in their mission of emphasizing construction. Strong accents are placed at important points—small elements are richer in color than large areas and, in general, warm colors act as supports to cool ones. In the Rotunda, the central dome, which should soar above the rest, is kept in a cool scheme of blue-green-violet, while the transepts, which support the dome, are in tones whose warmth emphasizes the height of the dome. In value and intensity, each color is suited to its part in the scheme. The varying degrees of richness in the decoration are based on the plan of the Library.

The Rotunda obviously should be, and is, the most elaborate in treatment. Since there are several rooms with similar beam systems, it was necessary to differentiate them in color. Each beamed ceiling, therefore, has a dominant tone, not too readily apparent but felt as one passes from room to room.



Julian E. Garnsey
A. W. Parsons
Mural Painters

Bertram G. Goodhue, *Architect*; Carleton M. Winslow, *Associate Architect*
Successors: Carleton M. Winslow and the Bertram G. Goodhue Associates

CEILING DETAIL
PUBLIC LIBRARY, LOS ANGELES, CALIFORNIA

The general effect of all this decoration somewhat resembles that which might be obtained by the insertion of small tiles or large tesserae in the concrete. But imitation of tile or mosaic was carefully avoided by a special process of over-glazing that retained the texture peculiar to concrete.



Julian E. Garnsey
A. W. Parsons
Mural Painters

Bertram G. Goodhue, *Architect*; Carleton M. Winslow, *Associate Architect*
Successors: Carleton M. Winslow and the Bertram G. Goodhue Associates

DETAIL OF ROTUNDA DOME
PUBLIC LIBRARY, LOS ANGELES, CALIFORNIA

At first glance this appears to be an excellent example of mosaic craftsmanship; yet it is only well studied designs painted on concrete. Such decoration provides a new method of ornamentation for monumental architecture at moderate cost.



Holabird and Roche, *Architects*

PORLAND CEMENT ASSOCIATION BUILDING, CHICAGO, ILLINOIS

Unusually large units of precast stone lend to the base of this structure a massiveness and stability which would not have been obtained by the use of masonry units of the usual size. The design provides for the addition of three stories.

THE PORTLAND CEMENT ASSOCIATION BUILDING

By JOHN A. HOLABIRD

THE object of the Portland Cement Association is to improve and extend the use of cement and concrete. Since this Association represents a large industry whose product is probably the most versatile material used in construction, it followed that when an office and laboratory building was to be erected for its exclusive use, cement and concrete were to be used wherever possible. Not only was concrete to be used structurally but for decoration as well. That this requirement placed no restraint on the design is apparent from the very successful results obtained.

The street facades are in precast concrete stone of a warm buff color with a faint suggestion of pink. Spandrel stones below the fourth story windows are verdi green of a metallic appearance. They are cast sculptured pieces portraying the mechanical advances made in cement manufacture. Below the fifth story windows are cast spandrel stones of the same color as the general exterior, designed to express the outstanding characteristics of concrete.

Throughout the vestibule, reception room and adjoining elevator lobby the floor surfacing is concrete art marble

tile. A similar material is used for trim around windows and doors, and for the dado in the elevator lobby. The walls in all these rooms are cast stone similar in texture and color to caen stone. The ceiling in the elevator lobby is concrete, stained a dark brown, with stenciled designs in rich colors applied to the heavy beams, directly over the stains.

On the main stairway, the concrete frame was covered with concrete art marble tile in buff and black. In order to prevent slipping, a certain proportion of abrasive material was added to the aggregates used in the treads of these stairs.

In the assembly room and several private offices the concrete floors were marked off into large squares and after hardening, were chemically treated by a patented process to give color in soft tones of green and brown. On the remainder of the floors occupied by the general offices, linoleum was cemented to the concrete. Elsewhere plain concrete floors proved quite suitable.

The ensemble is attractive and successful from every viewpoint. It illustrates in a most impressive and pleasing manner some of the many possibilities of concrete for decorative purposes.



Holabird and Roche, *Architects*

RECEPTION ROOM
PORTLAND CEMENT ASSOCIATION BUILDING, CHICAGO, ILLINOIS

The delicate shades and textures found in the best grades of caen stone have been reproduced in this precast wall surfacing. The floor coloring, which harmonizes with the entire color scheme, was accurately controlled by the use of precast concrete floor tile.



Holabird and Roche, *Architects*

CONCRETE DETAILS IN THE RECEPTION ROOM
PORTLAND CEMENT ASSOCIATION BUILDING, CHICAGO, ILLINOIS

The clean cut arrises of the column flutes and also the unusual concrete light standard and window trim are especially worthy of notice. Such details show that the use of fireproof materials need place no restraint on architectural design.



Holabird and Roche, *Architects*

ELEVATOR LOBBY
PORTLAND CEMENT ASSOCIATION BUILDING, CHICAGO, ILLINOIS

An excellent example illustrating that, through the use of concrete, color may be made a dominant factor in architectural design. The floor, walls and ceiling are all of concrete.

NOTES ON THE
DECORATION OF CONCRETE
STRUCTURES



PAINTED DECORATION ON CONCRETE

BY staining and painting concrete surfaces, a great variety of decorative effects can be obtained. After the concrete surfaces have been prepared in the proper manner, many stains, paints, enamels and varnishes may be used for decorations which range from the simplest stenciled designs to the richest and most elaborate of murals. In the following paragraphs the essential requirements for obtaining satisfactory and durable decoration on concrete are enumerated. It must be pointed out, however, that definite specifications or instructions can only supplement, and not replace, the knowledge and technique that are acquired by long experience. It is, therefore, recommended that the application of decorations on concrete be entrusted only to workmen who have had the necessary experience.

Form Work and the Placing of Concrete.—When a decorative scheme is to be achieved by the staining and painting of concrete, it should be realized before the concrete is placed that the final effect will depend largely upon the quality of the surface on which the decorations are applied and therefore, satisfactory textures and freedom from blemishes should be secured by especial care in the selection and preparation of the form lumber and in the placing of the concrete. The number of textures that can be secured on concrete surfaces is limited only by the skill and ingenuity of the workmen who prepare the forms.

The Thorough Drying of Concrete.—Too much emphasis cannot be laid on the thorough drying of all concrete work before painting is started. It should be remembered that all concrete structures contain considerable water when new and although concrete may appear dry it may still contain much

moisture just under the surface. Sufficient time under the proper conditions of temperature and humidity must be allowed for drying or the moisture in the concrete will eventually injure an oil-paint coating. It must be realized, however, that concrete should not be permitted to dry until after a proper period of curing has ensued. The concrete must be kept damp during the first week or ten days after placing in order to assist the chemical reactions which give to the concrete its strength and its durability.

Concrete on which painted decorations are applied must, of course, be free from infiltration of moisture from the outside.

The Preparation of the Surface.—The staining or painting of concrete should be preceded by the application of an aqueous solution of zinc sulphate (4 pounds of crystallized zinc sulphate to one gallon of water) in order to neutralize any lime that may have been deposited on the surface as a result of the chemical action that takes place during the hardening of concrete. If lime is left on the surface, in the presence of moisture it will tend to saponify the linseed oil in the stains or paints that are subsequently applied. By tinting the zinc sulphate solution with pigment color the danger of leaving untreated areas can be avoided.

Sufficient time—at least 48 hours—must be allowed for the neutralizing action and drying of the zinc sulphate solution before the addition of other material to the surface.

The zinc sulphate treatment is simple, effective and comparatively inexpensive, and it does not affect the most delicate paint pigments. Prominent interior decorators and research chemists recommend the use of an aqueous solution of zinc sulphate for preparing concrete surfaces to receive oil paints.

The Application of a Primer.—The next operation should be the application of a priming coat which partially fills the pores of the concrete and prevents the stain or oil paint from penetrating too deeply. A primer consisting of boiled linseed oil has proved satisfactory. By filling the pores, it reduces the suction of the concrete so that the oil and pigment in the paints are not separated. Some pigment color should be added to the boiled linseed oil primer in order to avoid leaving untreated areas. If the concrete is dense it may be necessary to add turpentine to the linseed oil in order to secure the correct amount of penetration.

The Application of Stains.—After the priming coat of boiled linseed oil has dried the concrete surface is then ready to receive the stains.

The most satisfactory and attractive decorations have been obtained by staining the entire surface and then applying paints only to small areas of brilliantly colored stenciled designs. By this treatment the textures of the concrete in the stained areas are seen plainly and become an integral part of the decoration.

Stains consisting of a mixture of boiled linseed and Chinawood oils, thinned with turpentine or naphtha and colored by pigments have proved satisfactory for use on concrete. A high grade linseed oil paint can be used as a stain if it is thinned sufficiently.

The Application of Paints.—When the stains have dried the stenciled decorations may be applied with paints. The formula of the paint may be adapted to the character of surface desired and the porosity of the concrete to which it is to be applied. Various combinations of white lead, lithopone, zinc oxide, titanium oxide and inert pigments mixed with either linseed oil or heavy-bodied enamel liquids have given excellent service. Tinting pigments should be alkali-proof and, of course, light-fast. Ready-mixed paints made by reputable manufacturers especially for the painting of concrete surfaces can generally be relied upon to give satisfactory results.

The Application of Protective Coatings.—To protect the painted surface, thin, clear varnishes or shellacs are often applied. By their use a glazed surface may be produced or an antique effect may be given to an entire color scheme. An additional protection that assists greatly in the cleaning of the surface is a coating of starch. When such a coating is removed by washing, any accumulation of soot or dirt on the surface is also removed. Afterwards, the surface may be recovered with a fresh coat of starch. The addition of such protective coatings, of course, increases the economy that is obtained by the staining and painting of decorations directly on concrete.

A NEW TECHNIQUE FOR EXPOSED AGGREGATE CONCRETE

THE technique used for making the exposed aggregate concrete illustrated in this book was developed by a small group of artists after many years of arduous work and study. Much artistic ability as well as a knowledge of the details of the process, supplemented by personal experiment and observation, is required to produce uniform surfaces of predetermined colors and textures.

It is almost as impossible to set down in specification form the requirements for this work, as it is to draft definite instructions for the painting of a picture. Nevertheless, some facts about the salient steps in the method usually employed may be of interest and are recorded here.

The Selection of the Aggregates.—The first step is, of course, the selection of aggregates which will properly render the architect's design. A vast variety of aggregates are available for exposed aggregate concrete. Stones of much decorative value but which are so hard to hew that they are seldom used for ornamentation, can be easily crushed and used for this work. Even such materials as ceramics, colored by the oxides of rare metals and burned with intense heat, as well as quartz and onyx have been used as aggregates with excellent results.

The Design of the Mix.—After crushing, the aggregates are screened and graded according to size. Then only those particles which are of the sizes that will give the desired texture are recombined in proportions that make a remarkably dense and uniform

mixture in which the voids constitute less than twenty per cent of the volume.

To this recombined mass of aggregates, portland cement and water are added in those proportions which will give a workable mix and which will, at the same time, give a strength at 28 days of approximately 3000 pounds per square inch to standard concrete test specimens made at this stage, when cured and tested by standard methods.

The Removal of Excess Water.—The concrete is deposited in molds without disturbing the uniform arrangement of the aggregate. Some water is now extracted from the concrete. The present practice is to leave in the concrete at this stage about four gallons of water for each sack of cement that was used in the mix.

The removal of the excess water, which was used as a vehicle for placing, increases the density, strength and impermeability—and consequently the durability—of the concrete and diminishes the shrinkage or tendency of the concrete to draw away from the molds during the process of hardening.

Exposing the Aggregate.—The forms are removed before the concrete has hardened too much and the surface is washed with a spray of water and scrubbed with a stiff brush until the aggregate is evenly exposed over the entire surface. When the concrete has become very hard, the surface is washed with a dilute solution of muriatic acid. All traces of the acid are subsequently removed by washing with clean water.

MOLDED CONCRETE ORNAMENTATION

VERY satisfactory and pleasing decoration may be obtained by embellishing concrete structures with molded concrete ornament. Such ornament may often be either precast or cast monolithically with the structure. In the past it has usually been assumed that the use of precast units was necessary for all but the simplest of ornaments. Nevertheless, in recent years it has been demonstrated that considerable surface enrichment may be obtained in a satisfactory manner by casting much of the concrete ornament in place.

Simple Means of Ornamentation.—Effective decoration in concrete can often be created very easily. Patterns of many varieties may be produced in concrete simply by nailing wooden blocks on the flat form surfaces. The simple planes of the ordinary form work may be easily modified to produce in the finished structure either raised or sunken lines or panels. Reveals and projections that are appropriate to the design can be readily formed so as to cast shadows that will add much to the effect of the architectural composition.

However, even for simple decoration, it must be realized that only skilled workmen who are capable of producing perfect ornament at the first attempt should be employed for casting ornament in place, because in this case the ornament becomes an integral part of the structure. When precast units are used, of course it is easy to detect imperfections in ornaments before they are set in place and to reject those with flaws.

Ornaments of Much Detail.—When the assistance of skilled mold makers is available, plaster molds for ornaments of considerable detail and refinement may be

made and subsequently erected together with the wooden forms. Of course care must be taken to see that the plaster molds are properly and securely fastened in place. Those faces of the plaster molds which give the form to the ornament should be protected from being spattered with concrete. If the mold is small this may be done by hanging a piece of canvas over it until the concrete is placed up to the level of the top of the mold, and then withdrawing the canvas and allowing the concrete to flow in.

If concrete is spattered on the surface of a plaster mold and permitted to dry somewhat before the concrete of the ornament is placed, it is apt to produce scars on the finished work. The concrete should be spaded from the middle of the form towards the face of the mold in order to assure proper filling and to eliminate air pockets.

Color and Texture in Molded Ornamentation.—An innumerable variety of colors and textures may be obtained in molded concrete ornament. For exterior ornament, colored aggregate and those mineral color pigments which may be safely added to the cement in small quantities are especially suitable. For interior ornament, stains, paints, enamels and varnishes are also available. An unusual tone of gray may be obtained by rubbing graphite into the pores of the concrete and afterwards covering the surface with shellac and varnish, and subsequently polishing. By placing layers of paint, Dutch metal, gold-leaf and varnish on concrete and by rubbing and polishing with pumice, a unique metallic appearance can be obtained.

PORTLAND CEMENT STUCCO AND PLASTER

PROBABLY the most widely used material for the decoration of monolithic concrete structures is portland cement stucco. When it is used for interior decoration it is usually referred to as portland cement plaster. The range of the decorative uses of this plastic material is very great. Artists and craftsmen can obtain in portland cement stucco a multiplicity of colors and textures, and they may manipulate it into finishes that blend with the most delicately molded detail or they may create in it surfaces that harmonize with the roughest of hewn stones.

The Bonding of Stuccos to Monolithic Concrete Surfaces.—In order to secure satisfactory stucco it is necessary to give much attention to those details of construction which produce an effective bond. If oil or grease is used on the form work it is apt to prevent effective bonding of the stucco to the monolithic concrete surfaces. In all cases, dirt, grease and form oil must be removed from concrete surfaces before either a single dash coat stucco or one of the heavier stuccos is applied.

When two-coat or three-coat stuccos are employed it is usually advisable to roughen the surface of the concrete before the application of the scratch coat. This may be done by removing the vertical forms before the concrete is too hard and then immediately brushing the surface with wire brushes. If the surface is allowed to harden too much the cost of roughening will increase greatly.

A special patented liquid material which facilitates the removal of surface layers of cement mortar is now obtainable. This liquid material is spread on the interior surfaces of the concrete forms and here it re-

tards the hardening of the cement mortar with which it comes in contact. If the forms are stripped within definite time limits, the aggregate may be easily exposed by brushing the concrete surface immediately after the forms are removed. The surface is washed with water after brushing and allowed to cure before the application of the scratch coat.

A good bond is, of course, at times not only dependent on the anchorage afforded by a roughened surface but it is also dependent on the amount of suction that is obtained. Suction is influenced greatly by the amount of moisture present in the concrete surface. It must be realized that concrete saturated with water will have practically no suction whereas thoroughly dry concrete will probably have too much.

The Application of Single Dash Coat Stuccos.—Excellent control of the final color of a monolithic concrete surface may be obtained by the use of a single dash coat of stucco. A mixture made in the proportions of one cubic foot of portland cement to one and one-half cubic feet of sand has proved very satisfactory when just sufficient water has been added to make a grout of thick, creamy consistency. This mixture should be dashed on the concrete surface with considerable force by means of a stiff brush and allowed to harden without any trowelling whatsoever.

Such a coating not only gives a more uniform color to a monolithic concrete structure but it also acts as a seal and diminishes the coarse appearance of the surface. It does not hide completely the texture of the monolithic concrete that lies beneath it. The form marks and other surface markings are still visible after the coating of stucco has been

applied and the structure still retains in full measure all the qualities of ruggedness, strength and natural integrity of the monolithic mass.

The range of finishes that may be obtained by the use of single dash coat stuccos is, however, very limited and two-coat and three-coat stuccos are used for producing effects that can not be obtained in the thinner stuccos.

The Application of Two-Coat and Three-Coat Stuccos.—The first coat of two-coat or three-coat stuccos should be a single dash coat of stucco mixed and applied in the manner described in one of the preceding paragraphs. It must be emphasized that this bonding or scratch coat must be dashed on the concrete surface with considerable force by means of a stiff brush and allowed to harden without any trowelling whatsoever because available evidence indicates that if the first coat is put on by trowelling then a considerable amount of air will be entrapped between the mortar and the surface of the concrete.

The second and finishing coats may, however, be trowelled on. Satisfactory mortars for these coats may be made of mixtures consisting of five sacks of portland cement, one fifty-pound sack of hydrated lime and sixteen cubic feet of sand. The mixtures for the finishing coat should, of course, have in addition the correct amount of mineral color pigments. Factory-mixed portland cement stuccos are recommended for the finishing coat because their use assures more uniform colors throughout a structure.

Three-coat work is usually superior to two-coat work because in the former the ad-

ditional coat gives better control of the suction and also of the coloring of the final coat. The colors of stuccos can now be controlled so accurately that skilled workmen can create stucco walls that resemble very closely in color and texture those made of imported and costly stone.

In some cases the cement-gun has been employed for the placing of the first coats of portland cement stuccos and only the finishing coat has been put on by hand. This method for the application of stucco on monolithic concrete surfaces has proved very satisfactory when the work has been done by men skilled in the use of the cement-gun.

Designs Executed in Colored Portland Cement Mortars.—Colored portland cement mortars may be used not only for broad surfaces but also for the creation of designs of much artistic merit which will withstand severe weathering conditions.

Satisfactory decorations in colored portland cement mortars can be obtained by the use of a series of stencils cut from light roofing material or sheet metal. These stencils are used as guides for placing the differently colored mortars in definite areas so as to create the desired design. The mortars may be applied by hand or by means of the cement-gun.

Another form of satisfactory decoration may be obtained by applying successive layers of differently colored mortars. The mortars are allowed to harden thoroughly and the design is then cut through to the desired layer or color. Pneumatic tools may, of course, be used for the cutting.

["Portland Cement Stucco," a booklet published by the Portland Cement Association, contains many illustrations in color and gives much technical information about stucco that is not included in these notes.]

Architects desiring additional information about the decoration of concrete structures or having some unusual problem in the use of cement, are invited to communicate with our nearest District Office. The advice of our technical staff will be supplied without charge.

PORLAND CEMENT ASSOCIATION
A National Organization to Improve and Extend the Uses of Concrete

DISTRICT OFFICES AT

| | | |
|----------------|----------------|-------------------|
| Atlanta | Jacksonville | Parkersburg |
| Birmingham | Kansas City | Philadelphia |
| Boston | Lincoln, Nebr. | Pittsburgh |
| Chicago | Los Angeles | Portland, Oreg. |
| Columbus, Ohio | Milwaukee | Richmond, Va. |
| Dallas | Minneapolis | Salt Lake City |
| Denver | Nashville | San Francisco |
| Des Moines | New Orleans | Seattle |
| Detroit | New York | St. Louis |
| Helena, Mont. | Oklahoma City | Vancouver, B. C. |
| Indianapolis | | Washington, D. C. |

